

WHAT IS CLAIMED IS:

1. A zirconia-containing ceramic composition capable of providing a thermal barrier coating wherein the zirconia is stabilized in the cubic crystalline phase, and which comprises:
 1. at least about 50 mole % zirconia; and
 2. a stabilizing amount up to about 49 mole % of a stabilizer component comprising:
 - a. a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the composition;
 - b. a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the composition; and
 3. one or more of a third metal oxide selected from the group consisting of:
 - a. hafnia in an amount from about 0.5 to about 40 mole % of the composition; and
 - b. tantala in an amount of from about 0.5 to about 10 mole % of the composition.
2. The composition of claim 1 which comprises from about 50 to about 90 mole % zirconia and from about 5 to about 49 mole % stabilizer component.
3. The composition of claim 2 which comprises from about 60 to about 85 mole % zirconia, from about 10 to about 30 mole % stabilizer component and from about 5 to about 25 mole % hafnia.
4. The composition of claim 2 which comprises from about 2 to about 8 mole % tantala.
5. The composition of claim 2 wherein the stabilizer component comprises the first metal oxide in an amount of from about 10 to about 40 mole % of the composition and the second metal oxide in an amount of about 2 mole % or less of the

composition.

6. The composition of claim 5 wherein the first metal oxide is selected from the group consisting of neodymia, ytterbia, mixtures of neodymia and lanthana and mixtures of ytterbia and lanthana, wherein the lanthana is included in the mixtures in an amount of from about 1 to about 10 mole % of the composition.
7. The composition of claim 6 wherein lanthana is included in the mixtures in an amount of from about 2 to about 8 mole % of the composition.
8. The composition of claim 6 wherein the first metal oxide is neodymia.
9. A thermally protected article, which comprises:
 - A. a substrate; and
 - B. a thermal barrier coating that is stabilized in the cubic crystalline phase, and which comprises:
 1. at least about 50 mole % zirconia; and
 2. a stabilizing amount up to about 49 mole % of a stabilizer component comprising:
 - a. a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the thermal barrier coating;
 - b. a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the thermal barrier coating; and
3. one or more of a third metal oxide selected from the group consisting of:
 - a. hafnia in an amount from about 0.5 to about 40 mole % of the thermal barrier coating; and
 - b. tantala in an amount of from about 0.5 to about 10 mole % of

the thermal barrier coating.

10. The article of claim 9 wherein the substrate is a metal substrate, wherein the article further comprises a bond coat layer adjacent to and overlaying the metal substrate and wherein the thermal barrier coating is adjacent to and overlies the bond coat layer.
11. The article of claim 10 wherein the thermal barrier coating has a thickness of from about 1 to about 100 mils.
12. The article of claim 11 wherein the thermal barrier coating has a strain-tolerant columnar structure.
13. The article of claim 12 wherein the thermal barrier coating comprises from about 50 to about 90 mole % zirconia and from about 5 to about 49 mole % stabilizer.
14. The article of claim 13 wherein the thermal barrier coating comprises from about 60 to about 85 mole % zirconia, from about 10 to about 30 mole % stabilizer component and 99component and from about 5 to about 25 mole % hafnia.
15. The article of claim 14 wherein the thermal barrier coating comprises from about 2 to about 8 mole % tantala.
16. The article of claim 13 wherein the stabilizer component comprises the first metal oxide in an amount of from about 10 to about 40 mole % of the thermal barrier coating and the second metal oxide in an amount of about 2 mole % or less of the thermal barrier coating.
17. The article of claim 16 wherein the first metal oxide is selected from the group consisting of neodymia, ytterbia, mixtures of neodymia and lanthana and mixtures of ytterbia and lanthana, wherein the lanthana is included in the mixtures in an amount of from about 1 to about 10 mole % of the thermal barrier coating.
18. The article of claim 17 wherein lanthana is included in the mixtures in an amount of

from about 2 to about 8 mole % of the thermal barrier coating.

19. The article of claim 17 wherein the first metal oxide is neodymia.
20. The article of claim 12 which is a turbine engine component.
21. The article of claim 20 which is a turbine shroud and wherein the thermal barrier coating has a thickness of from about 30 to about 70 mils.
22. The article of claim 20 which is a turbine airfoil and wherein the thermal barrier coating has a thickness of from about 3 to about 15 mils.
23. A method for preparing a thermal barrier coating on an underlying substrate, the method comprising the step of:
 - A. forming a thermal barrier coating over the metal substrate by depositing a zirconia-containing ceramic composition so that the zirconia is stabilized in the cubic crystalline phase, the ceramic composition comprising:
 1. at least about 50 mole % zirconia; and; and
 2. a stabilizing amount up to about 49 mole % of a stabilizer component comprising::
 - a. a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the ceramic composition;
 - b. a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the ceramic composition; and
 4. one or more of a third metal oxide selected from the group consisting of:
 - a. hafnia in an amount from about 0.5 to about 40 mole % of the

- ceramic composition; and
- b. tantala in an amount of from about 0.5 to about 10 mole % of the ceramic composition.
24. The method of claim 23 wherein the substrate is a metal substrate, wherein a bond coat layer is adjacent to and overlies the metal substrate and wherein the thermal barrier coating is formed on the bond coat layer.
25. The method of claim 23 wherein the ceramic composition is deposited by physical vapor deposition to form a thermal barrier coating having a strain-tolerant columnar structure.